


Bridging the gap between test cycle(s) and real life fuel economy

Development of a realistic fuel consumption and pollutant labelling system of light-duty vehicles

Current situation, important issues, first ideas

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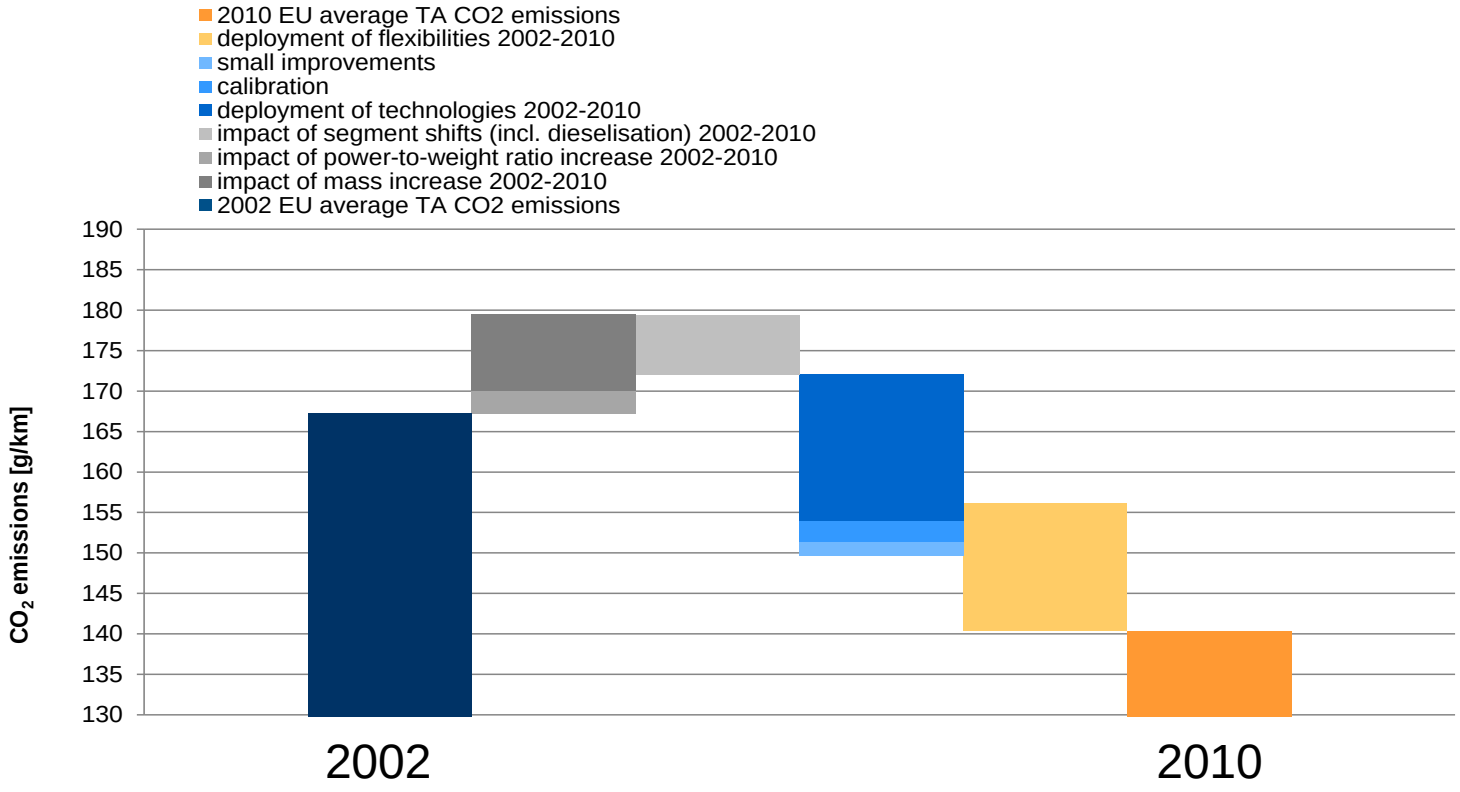
1. Flexibilities 2002-2010, Type Approval!

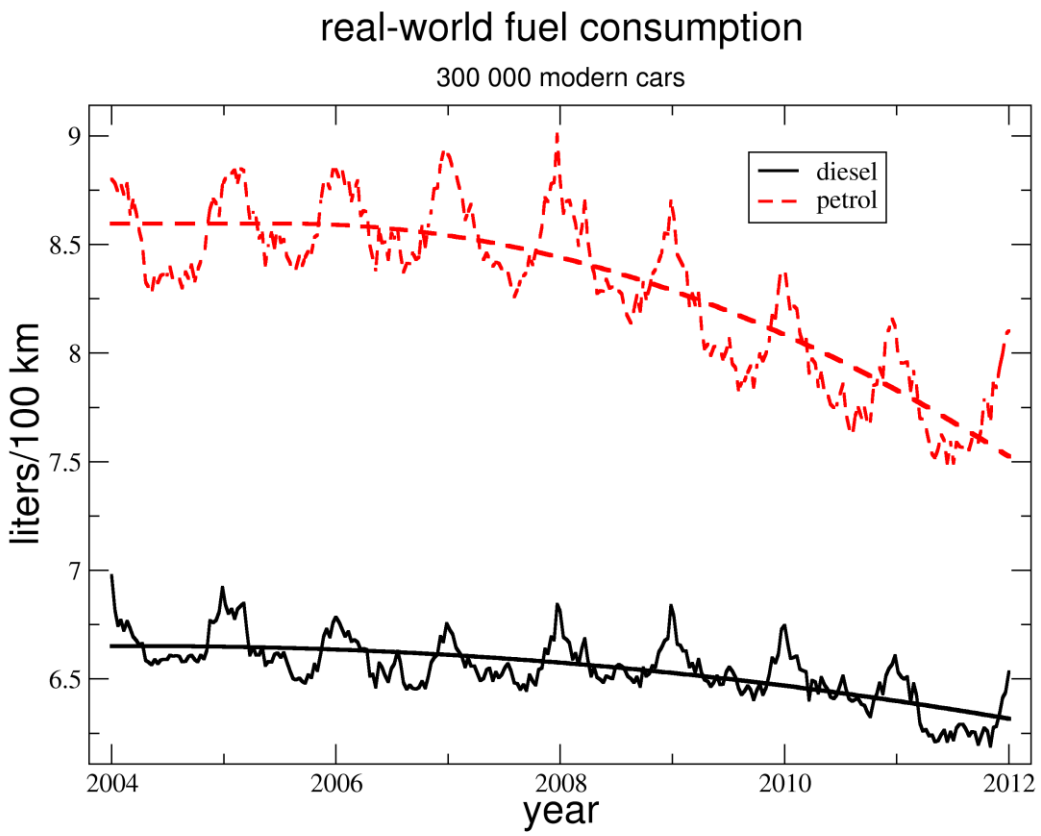


Between 2002 and 2010 the average CO_2 emission reduction (16%) in the Type Approval test of European passenger cars was caused by application of new technologies (2/3) and flexibilities (1/3).

1. Trend of real world fuel consumption

based on refuelling data of 300.000 vehicles in The Netherlands

no correlation found with wind, humidity, etc.



- 10% annual variation
- light-duty
- “Christmas peaks”
- downward trends 2004-2011

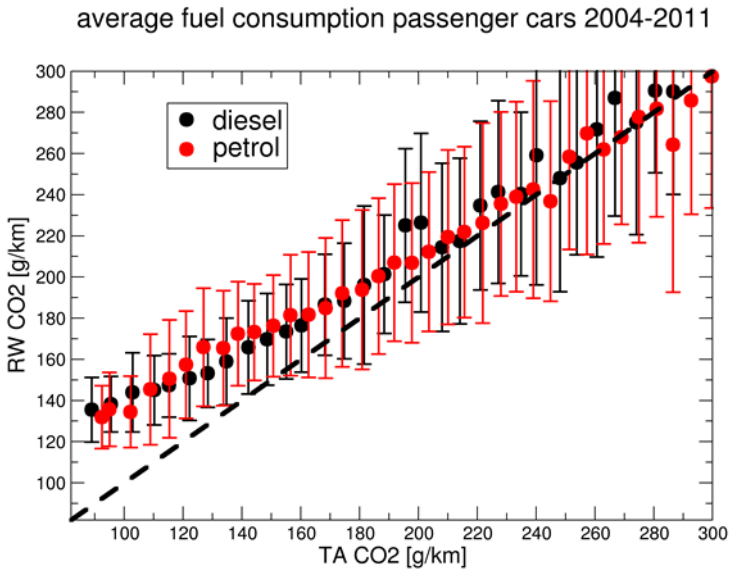

1. Type Approval and real world fuel consumption

		2002	2010	Reduction 2002-2010
EU27 average	CO_2 [g/km]	167,2	140,4	-16.0%
NL 300.000 vehicles Refuel data	Petrol [l/100 km]	8,6	8,0	-7,0%
	Diesel [l/100 km]	6,7	6,4	-3,8%

Over the period 2002-2010: The registered EU27 CO_2 reduction is 16,0 %.

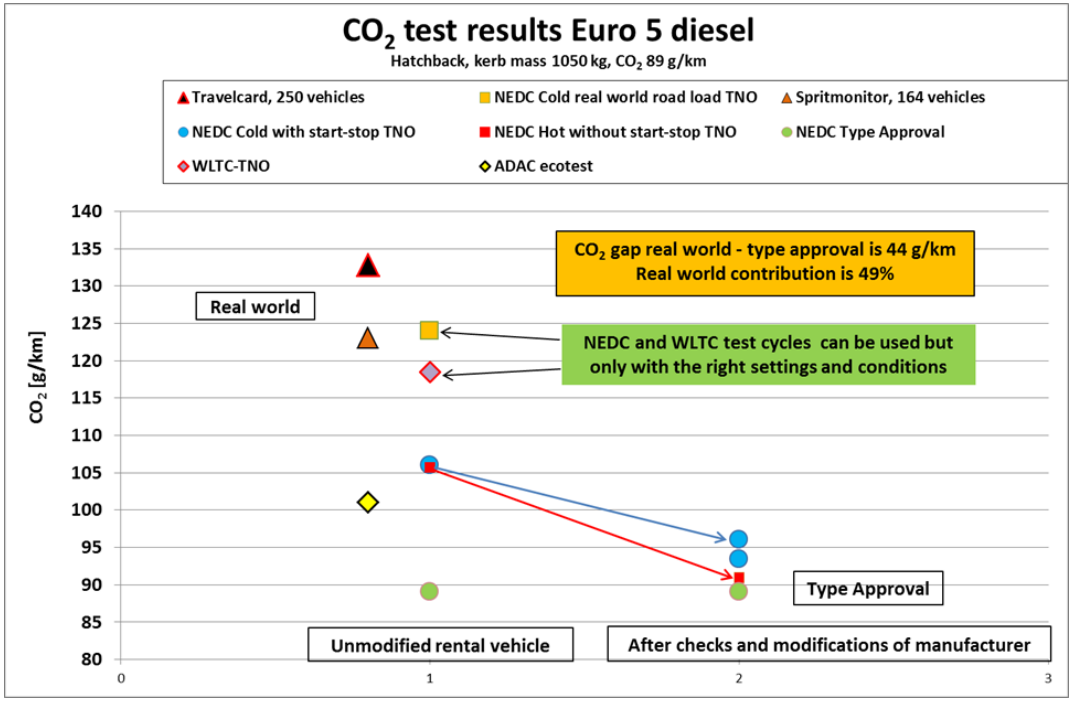
Based on Dutch **real world** fuel consumption data the FC reduction is 5,4%.
1/3 technology and 2/3 flexibilities

1. Real world versus TA fuel consumption



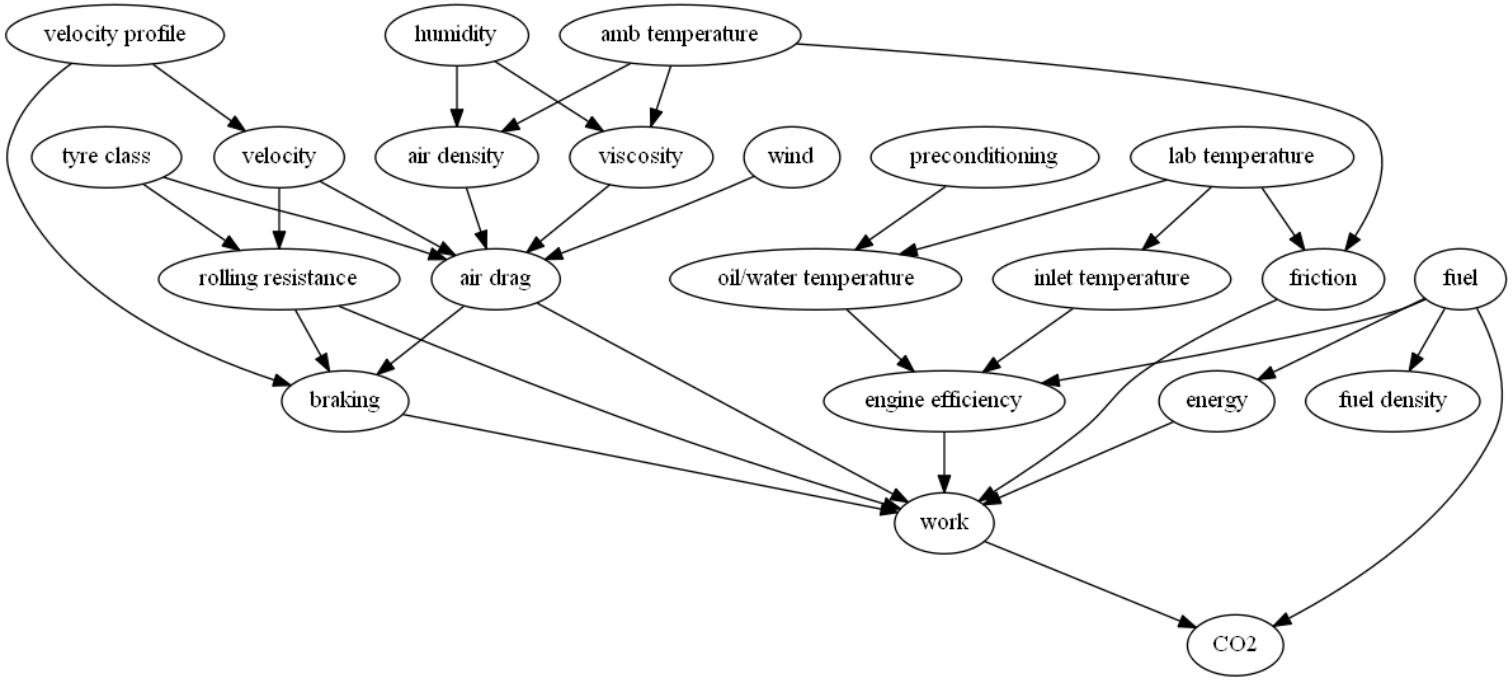
- 300.000 Consumers experience on average 0-50% higher fuel consumption than the Type Approval values. **The gap increases with lower TA-values**

1. Real world versus TA fuel consumption



- Production vehicles deviate from Type Approval test vehicles
- Real world numbers (+40%) can be obtained with **adapted** chassis dynamometer **settings** and different vehicle conditions

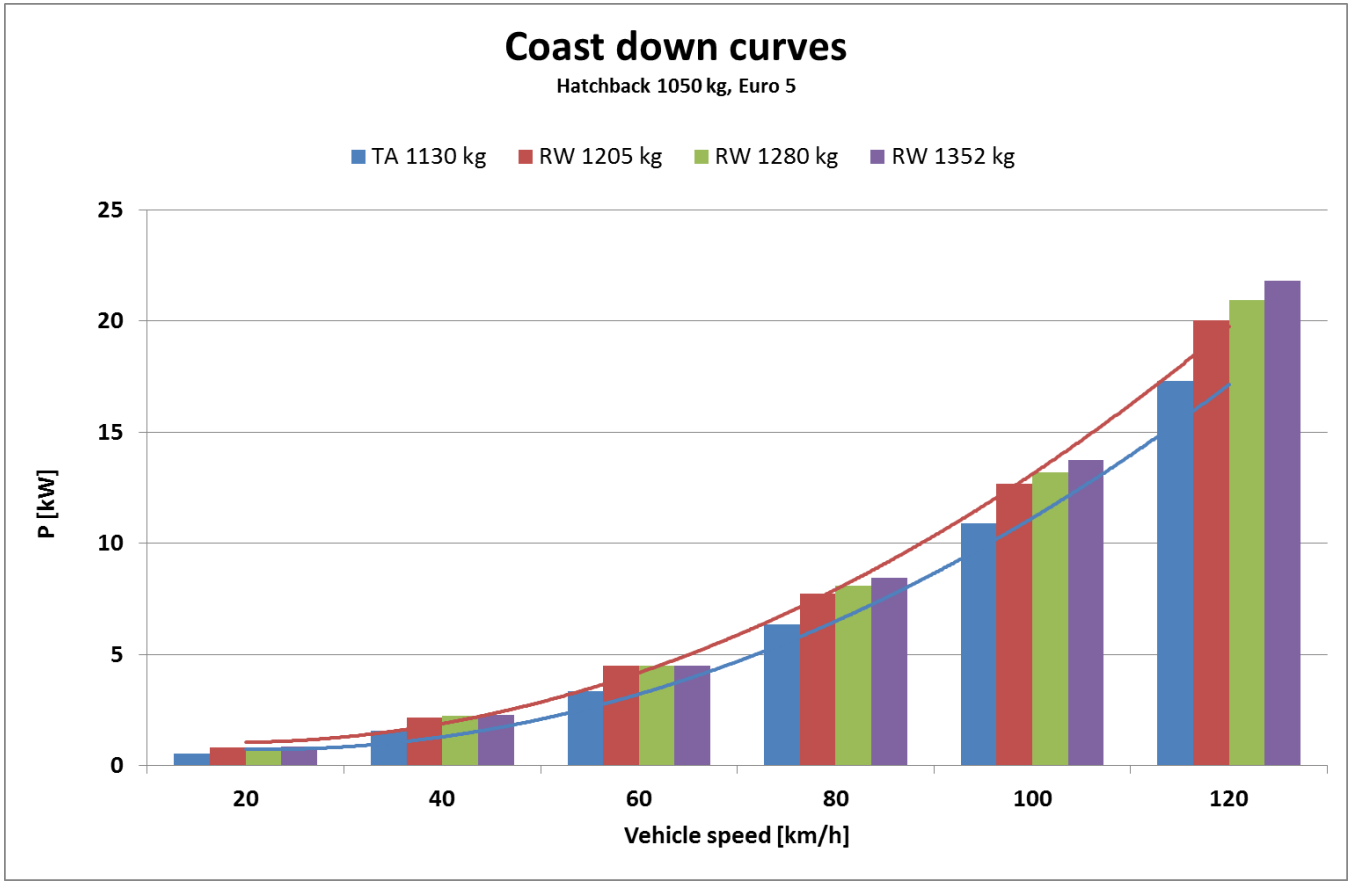
What influences CO_2 emissions?



- A good and realistic test procedure covers these items

1. What are important settings and conditions?

Adapted chassis dynamometer settings + production vehicle




1. Sprittmonitor and fuel consumption range

167 diesel vehicles, TA value = 89 g CO_2 per km (3,3 l / 100 km)

FC [l/100 km]	Number of vehicles
3,0	1
3,5	4
3,9	17
4,3	36
4,7	59
5,2	25
5,7	17
5,9	7
7,0	1

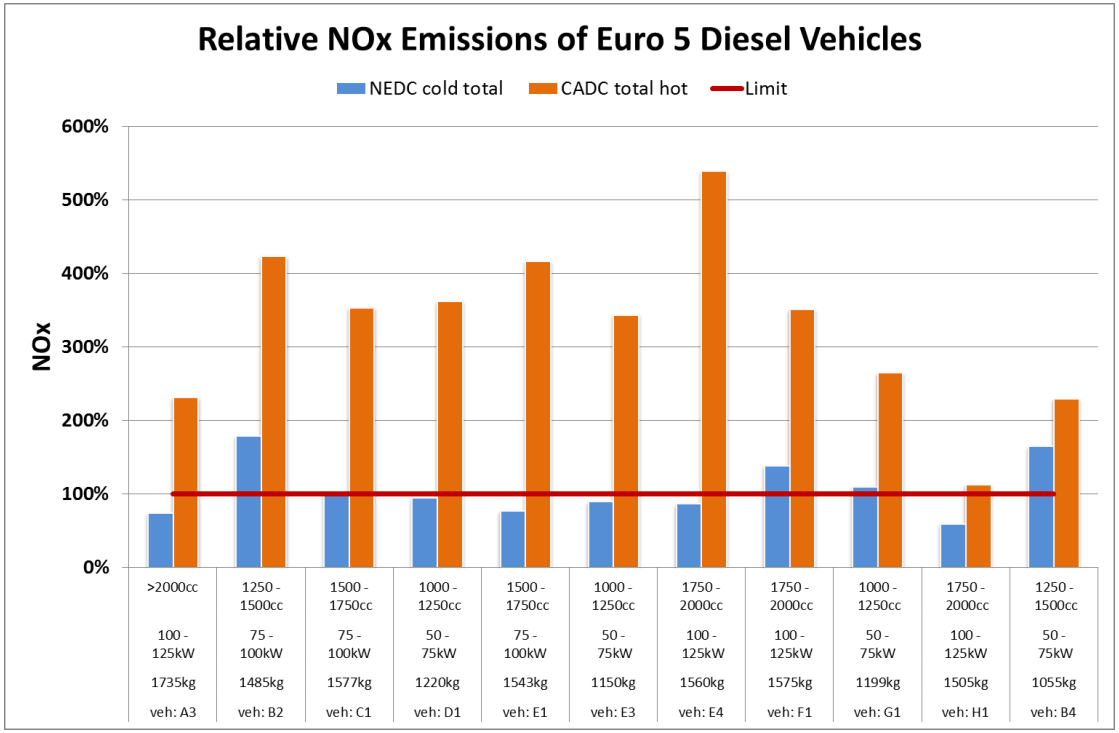
Real world FC varies a lot.
(3,5 – 5,9 l/100 km)

A new test procedure which yields these different fuel consumption levels might be easier accepted by consumers and the automotive industry


1. What causes the gap?

Example relationship real world and Type Approval average case					
	Reduction	CO2	CO2	FC	FC
	[%]	[%]	[g/km]	[km/l]	[l/100 km]
Real world		100%	139	18,9	5,3
Ambient conditions	5	96%	136	19,3	5,2
Status + condition vehicle	5	91%	133	19,8	5,1
Driving behaviour + use	16	77%	111	23,6	4,2
Maintenance	2	75%	107	24,5	4,1
Production spread vehicle	5	72%	101	25,9	3,9
Optimisation chassis dyno test	5	68%	98	26,7	3,7
Optimisation road load curve	6	65%	94	27,9	3,6
Administrative corrrections	4	62%	87	30,1	3,3
Type Approval value		62%	87	30,1	3,3
0					
Extra FC in real world			60%	60%	60%
Difference RW-TA			-37%	-37%	-37%

1. Real world Nox emissions diesel vehicles



- Authorities face high real world NOx emissions for LD diesel vehicles
- Real world CO, THC and PM10 emissions are OK.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2. Main steps of labelling methodology

1. Definition of the test sample (how to deal with variety of vehicles?)

2. Generation of **realistic** fuel consumption and emission test results (without flexibilities)

3. Calculation of the score (Test results are input for calculation methodology)

In order to obtain realistic test results an adapted test procedure is needed. What are the requirements for the new test procedure?


3. Issues to be redefined for development of a new test procedure

1. Definition of test sample (unprepared production vehicle)
2. Vehicle running in, preconditioning, soak, test fuel
3. Definition of **chassis dynamometer test with adapted settings**
4. Road load test (simulation of rolling resistance and air drag)
5. Vehicle mass simulation and vehicle configuration
6. Test cycles (NEDC, CADC, WLTC, cold and hot start, gear shift pattern)
7. Test conditions (Use of auxiliaries, temperature)
8. Regeneration of diesel particulate filters (fuel penalty)
9. Repeatability of results and required number of tests
10. Technical assistance of manufacturers (conditions, start-stop)


4. Global NCAP issues

- Proposal requirements test procedure:
  - Realistic, trustworthy, honest, transparent and cheap.
  - Accepted by consumers.
  - Accepted by automotive industry!
  - Limit values on a sliding scale.
  - Fase-in and soft landing of limit values.
  - Bonus-malus methodology.
  - Based on current test procedures (WLTP or NEDC).

Recommendation: Discussion Global NCAP and ACEA


5. Conclusions

- 1. The test sample must be an **unprepared production vehicle**.
- 2. Realistic CO_2 test results, which can be recognised by consumers, can be achieved with a NEDC, CADC or WLTC test with **adapted test conditions.**
- 3. In order to obtain realistic NOx test results WLTC or CADC test cycles with **adapted test conditions** can be applied.


5. Discussion

- 1. The Third World as well as Europe needs a real world fuel consumption test with realistic numbers. Currently this test is not available.
- 2. WLTP will not yield fuel consumption numbers that will be recognised by consumers
- 3. Real world fuel consumption differs from driver to driver and per case. The corresponding fuel consumption range must be part of the new Real World Light duty Test Procedure (RWLTP)


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Thank you very much for your attention!

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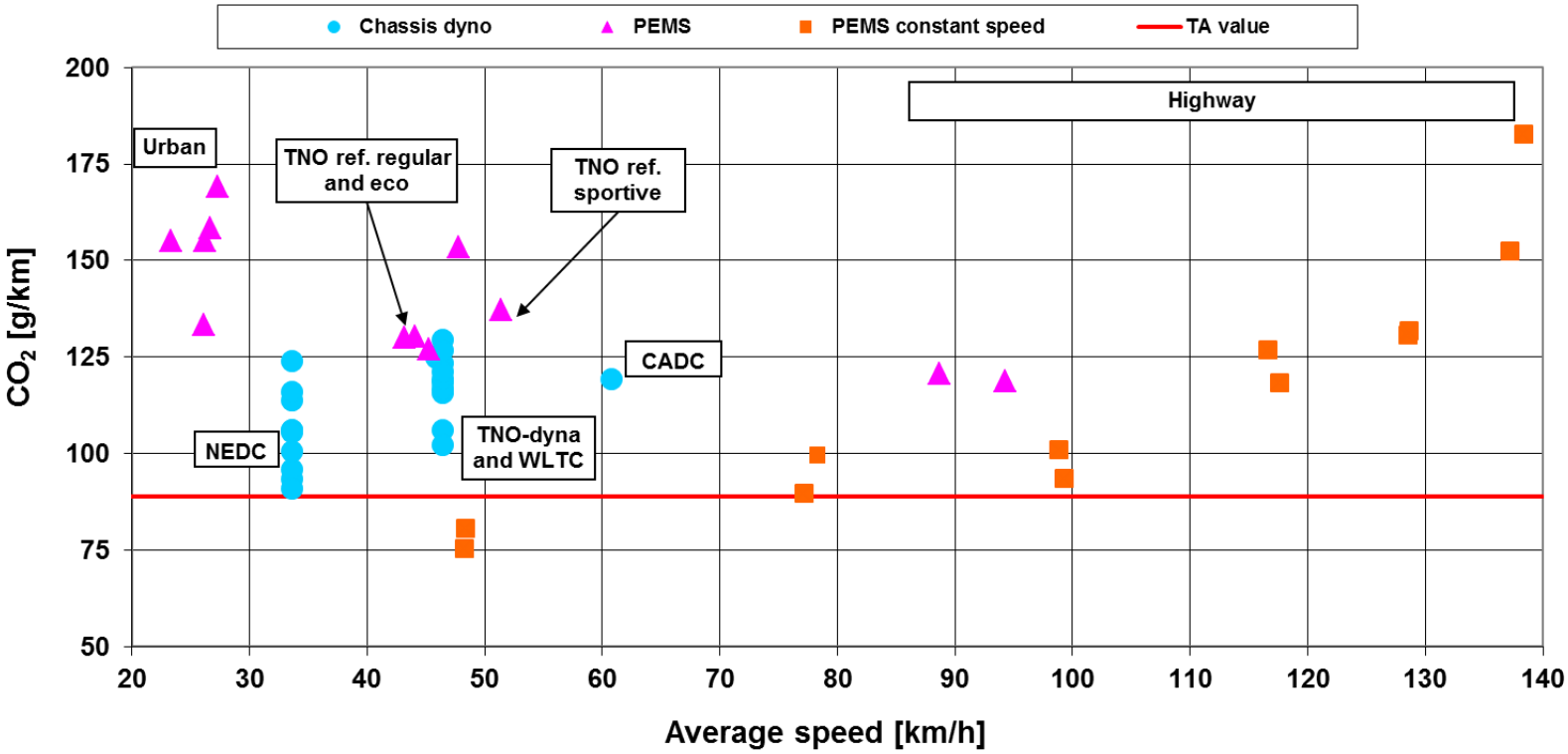
PEMS and chassis dyno CO_2 emissions with different chassis dynamometer settings

Hatchback Euro 5 diesel, 1130 kg, CO_2 = 89 g/km

For PEMS testing air conditioning not active

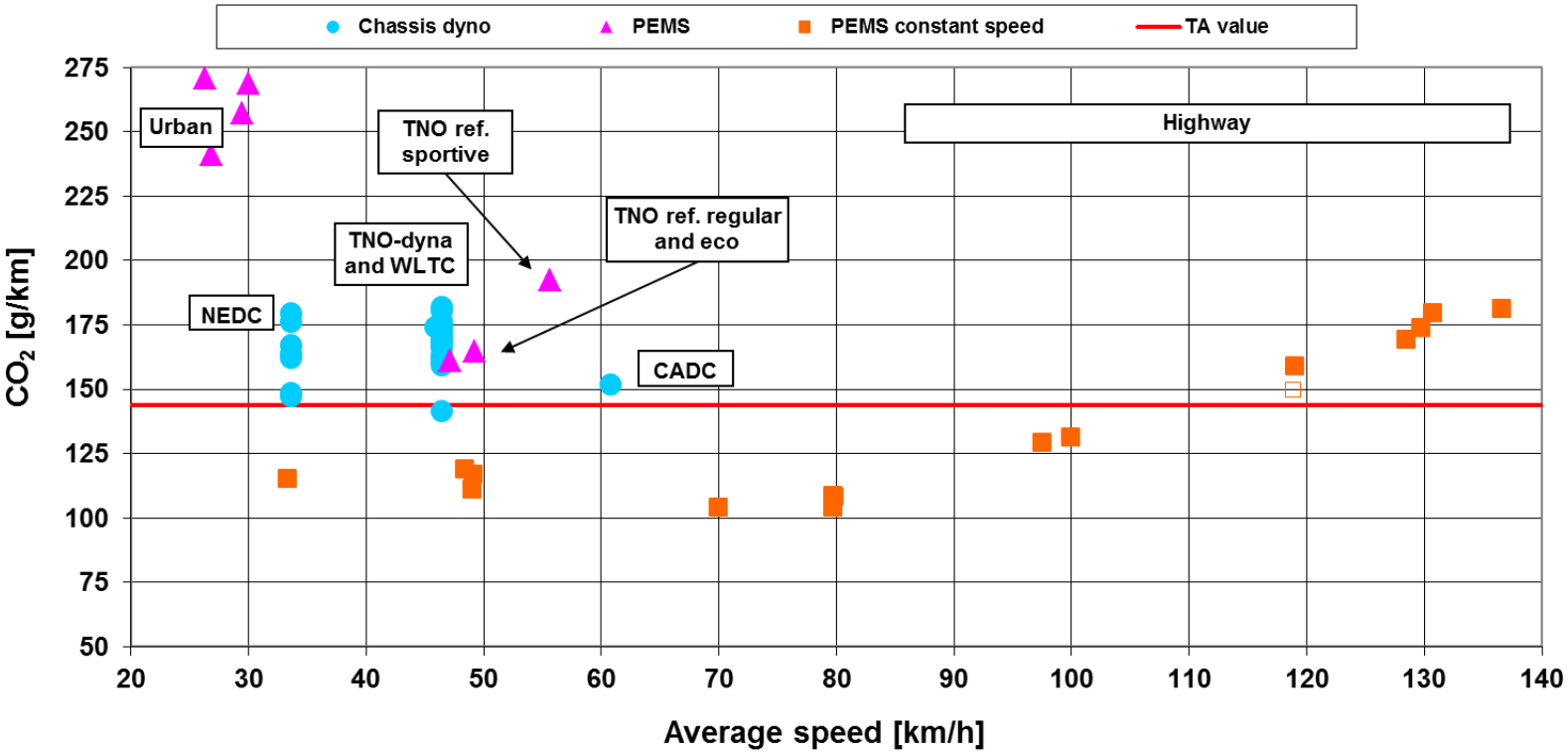


For each test cycle (NEDC, WLTC or CADC) the **test conditions** have a major impact on measured CO_2 emissions (22-24%).

PEMS and chassis dyno CO_2 emissions with different chassis dynamometer settings

Sedan Euro 5 petrol, 1475 kg, CO_2 = 144 g/km

For PEMS testing air conditioning not active



For each test cycle (NEDC, WLTC or CADC) the **test conditions** have a major impact on measured CO_2 emissions (10-20%).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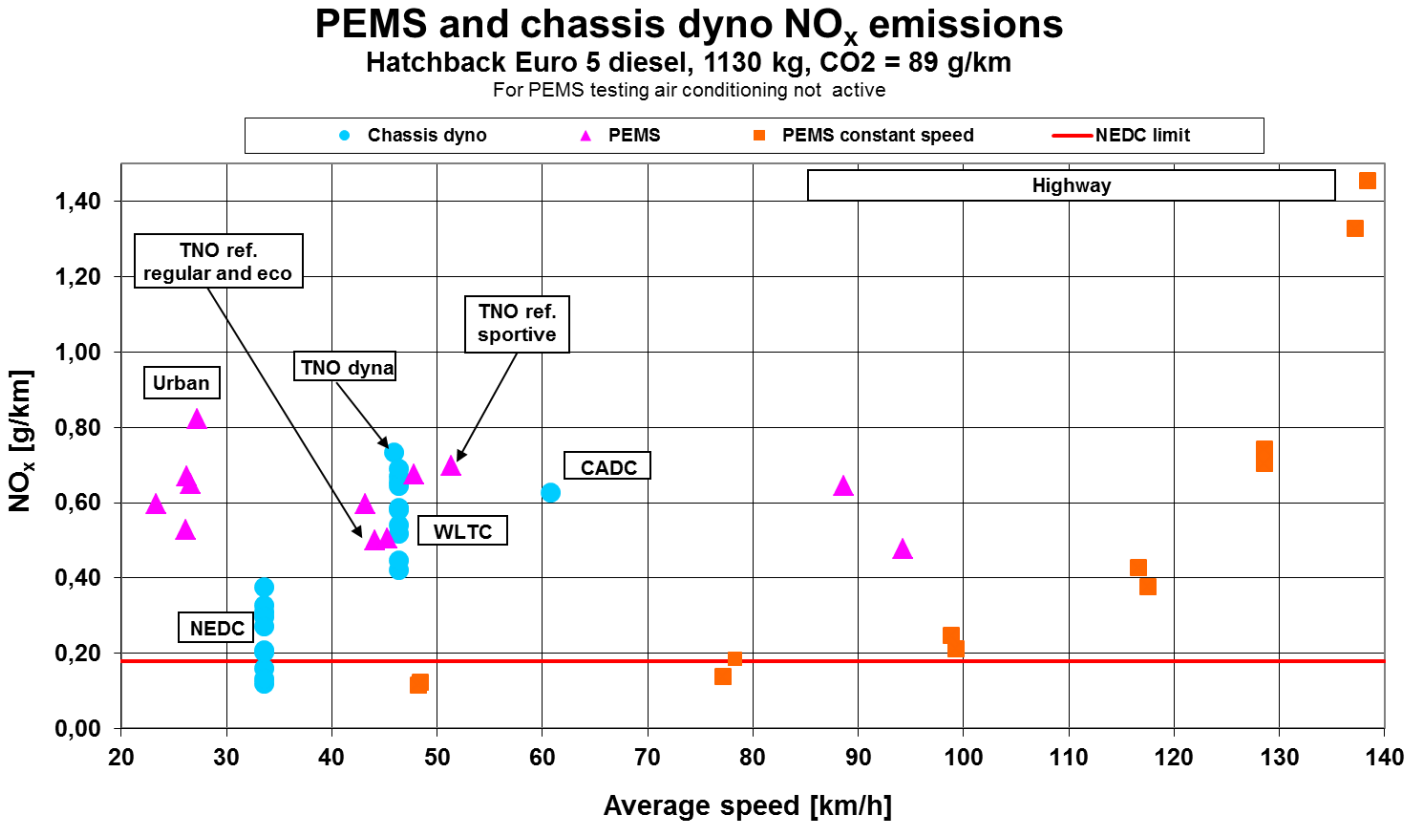

In order to obtain realistic NO_x test results WLTC or CADC test cycles with **adapted test conditions** can be applied .